Solution Guide for Chapter 13

Here are the solutions for the "Doing the Math" exercises in *Kiss My Math*!

DTM from p.193-4

Refer to p.3-7 of the Chapter 11 Solutions PDF for these!

2. After doubling the money in her bank account, Trudy spent $5 on music downloads. If she now has $195, how much money did she start off with? (Solve for *s*!)

In Chapter 11, page XX, problem #2, we discovered that **she has "2*s* – 5" dollars now.** If we are being told that she has $195 now, then we know this equation is true:

$$2s - 5 = 195$$

Do you see why? Each side represents how much money she has now. On the left, it's just written in terms of s, the starting amount. Solving this equation will allow us to find the starting amount!

So let's solve this:

$$2s - 5 = 195$$

First, we'll add 5 to both sides:

$$\rightarrow 2s - 5 + 5 = 195 + 5$$

$$\rightarrow 2s = 200$$

now we divide both sides by 2:

$$\rightarrow \frac{2s}{\mathbf{2}} = \frac{200}{\mathbf{2}}$$

$$\rightarrow \underline{s = 100}$$

So, Trudy started off with $100! And this makes sense, because if she first doubled it, she's have $200, and then after spending $5 on downloads, she's have $200 – $5 = $195.

Answer: **Trudy started off with $100.**

3. Brittany loves frozen grapes – she has a whole bowl of them. She eats 5 frozen grapes and shares the rest equally among herself and her 4 friends – Anne, Nicole, Aliza and Kirsten. Nicole got 7 frozen grapes. How many did Brittany start off with? (Solve for *s*!)

In Chapter 11, page XXX, problem #4, we found that **Each friend got $\frac{s - 5}{6}$ grapes.**

So, that means that, written in terms of *s*, Nicole got $\frac{s-5}{6}$ grapes. But now we're told that Nicole got 7 grapes which means that $\frac{s-5}{6} = 7$

Let's solve it!

$$\frac{s-5}{6} = 7$$

To get *s* by itself (undoing PEMDAS), first we'll multiply both sides by 6:

$$\frac{\mathbf{6}}{\mathbf{1}}\left(\frac{s-5}{6}\right) = \mathbf{6}(7)$$

$$\rightarrow \frac{6(s-5)}{6} = 42$$

The 6's will cancel on the fraction, just like we engineered them to:

$$\rightarrow (s - 5) = 42$$

$$\rightarrow s - 5 = 42$$

Add 5 to both sides:

$$\rightarrow s - 5 + \mathbf{5} = 42 + \mathbf{5}$$

$$\rightarrow \underline{s = 47}$$

Does this answer make sense? Well, if Brittany started off with 47 frozen grapes, and she first ate 5 of them, she'd have 42 frozen grapes. Then, if she shared these 42 frozen grapes between herself and her 5 friends (6 people total), that would divide the 42 into 6 equal parts, which is 7 frozen grapes each. Yep! We did it correctly, because it told us that Nicole got 7 frozen grapes!

Answer: **Brittany started off with 47 frozen grapes.**

4. Chris had way too many text messages on his phone, and wanted to clear them out. He first deleted 10 text messages, but he still had way too many, so he deleted half of what was left. If he currently has 8 text messages in his phone now, how many did he start out with? (Solve for *s*!)

In Chapter 11, page XXX, problem #5, we discovered that **Chris now has $\frac{s-10}{2}$ text messages.** So, since we're now told that he now has 8 text messages in his phone, that means: $\frac{s-10}{2} = 8$

Let's solve it!

$$\frac{s-10}{2} = 8$$

First we'll multiply both sides by 2:

$$\rightarrow \frac{\mathbf{2}}{\mathbf{1}}\left(\frac{s-10}{2}\right) = (\mathbf{2})(8)$$

$$\rightarrow \frac{2(s-10)}{2} = 16$$

The 2's cancel, and we get:

$$\rightarrow (s - 10) = 16$$

$$\rightarrow s - 10 = 16$$

now we add 10 to both sides, and get:

$$\rightarrow s - 10 + \mathbf{10} = 16 + \mathbf{10}$$

$$\rightarrow \underline{s = 26}$$

Does this answer make sense? If Chris started with 26 text messages, and first deleted 10 of them, he'd have 16 messages. If then he deleted half of what was left, 8 messages, then he'd be left with 8 messages, which is what the problem said!

Answer: **Chris started off with 26 text messages.**

5. Sarah had a lot of ringtones in her phone yesterday. But she kept adding to them, and today she has 9 more than twice what she started out with! If she now has 51 ringtones, how many did she have yesterday? (Solve for *y*!)

In Chapter 11, page XXX, problem #6, we discovered that **Sarah has 2*y* + 9 ringtones now**. We're now being told that Sarah currently has 51 ringtones, which means that we can set up this equation, which we know to be true: $2y + 9 = 51$.

Let's solve it!

$$2y + 9 = 51$$

First we'll subtract 9 from both sides, and get:

$$2y + 9 \mathbf{- 9} = 51 \mathbf{- 9}$$

(Resist the urge to use your calculator! If you subtracted 51 – 10, you'd get 41, right? So this should be 1 more than 41, because we're *subtracting* 1 *less*. Use that brain!)

$$\rightarrow 2y = 42$$

Now we divide by 2:

$$\frac{2y}{\mathbf{2}} = \frac{42}{\mathbf{2}}$$

$$\rightarrow \underline{y = 21}$$

Does this answer make sense? If Sarah had 21 ringtones yesterday, and now she has "9 more than twice" than that, well: "Twice 21" equals 42. What's "9 more than that?" 42 + 9 = 51. Yep!

Answer: **Sarah started out with 21 ringtones.**

6. Suzanne works at a pet store. During the morning of her last day working there, she had lots of puppies sitting in the playpen. By the end of the day, she'd sold $\frac{4}{5}$ of them. Of those remaining, she took 2 home to keep for herself. And guess what? She didn't leave any puppies behind. How many did she start off with that morning? (Solve for *m*!)

In Chapter 11, p.XXX, problem #7, we discovered that: **After Suzanne goes home, there are $\frac{1}{5}m - 2$ puppies left at the store.** So now we're being told that she didn't leave any puppies behind! So that means the number of puppies left in the store is 0. So we can build this equation: $\frac{1}{5}m - 2 = 0$

Let's solve it!

$$\frac{1}{5}m - 2 = 0$$

First, undoing PEMDAS, let's add 2 to both sides:

$$\rightarrow \frac{1}{5}m - 2 + \mathbf{2} = 0 + \mathbf{2}$$

$$\rightarrow \frac{1}{5}m = 2$$

Now, let's multiply both sides by 5, and watch that fraction disappear!

$$\frac{\mathbf{5}}{\mathbf{1}}\left(\frac{1}{5}m\right) = \mathbf{5}(2)$$

Yep, the 5's cancel each other on the left side, and we get:

$$\rightarrow \underline{m = 10}$$

Does this answer make sense? If she started with 10 puppies, and sold $\frac{4}{5}$ of them, that means she sold $\frac{4}{5} \times 10 = \frac{40}{5} = 8$ puppies. If she sold 8 puppies, that means there would only be 10 – 8 = 2 puppies left. And the problem says that she took 2 puppies home with her, so yep, that's all the puppies, and none are left at the store!

Answer: **There were 10 puppies at the store that morning.**

DTM from p.203-4

2. A purse and matching shoes cost a total of $95. If the shoes cost $55 more than the purse, how much does the purse cost? *(Don't jump to conclusions here!)*

Most people would look at this and jump to conclusions, thinking the purse costs $40 – but that would be wrong! After all, the shoes don't *cost* $55; they cost $55 *more* than the purse...

So, let's get label-happy! Let's call the cost of the purse "*p*" and the cost of the shoes "*s*." Then their total is: $p + s = 95$. The other information we have is that the shoes cost $55 more than the purse, which means that *s* is 55 more than *p*, in other words, translating:

$s = 55 + p$

and our other equation: $p + s = 95$

So now we have two equations and two variables, so let's plug in "$55 + p$" for *s* in the second equation, and we'll get: $p + (55 + p) = 95$

Finally! One equation, with one variable. Let's solve it!

$$p + (55 + p) = 95$$

(notice we can use the associative and commutative properties of addition to rearrange this)

$$\rightarrow 2p + 55 = 95$$

$$\rightarrow 2p + 55 \mathbf{- 55} = 95 \mathbf{- 55}$$

$$\rightarrow 2p = 40$$

$$\rightarrow \frac{2p}{\mathbf{2}} = \frac{40}{\mathbf{2}}$$

$$\rightarrow \underline{p = 20}$$

Let's see if this answer makes sense: If the purse costs $20, and shoes cost $55 more than the purse, that means the shoes cost $75, right? And $20 + $75 = $95. Yep! We got the right answer!

Answer: **The purse costs $20.**

3. Your mom has offered you $4/hr to clean the garage, plus a $10 bonus if you start by 8am on Saturday. Your dad has offered you $4.50/hr to clean the basement. Each job would take all weekend. Before you decide which offer you'll accept, you want to figure out this: **a.** Assuming you start by 8am on Saturday, if you only want to work 15 hours this weekend, which offer is better? **b**. How many hours would you have to work, for their offers to be equal?

For part a, we want to assume that we'll only be working for 15 hours, and we want to determine which is the better deal. First, let's write an expression for the number of dollars you'd make if you take your mom's offer, and your dad's offer. Assuming that

you start by 8am on Saturday, you'll get the $10 bonus from your mom. Since on top of that, you'd make $4/hr, then:

Money made with mom's offer = $4h + 10$

Money made with dad's offer = $4.5h$

If you work for mom for 15 hours, we just need to stick in "15" wherever you see *h*, so that would be: $(15)(4) + 10 = 60 + 10 =$ $70.

And if you work for dad for 15 hours, you'd get: $(15)(4.5) = (15)(4 + 0.5) = 60 + 7.5 =$ $67.50. Looks like mom's deal is better, if you work for 15 hours!

Now, for part b. Hm, looks like the thing we don't know is the "hours worked", so let's call that "h." Remember our two expressions:

Money made with mom's offer = $4h + 10$

Money made with dad's offer = $4.5h$

Now, if we set these two expressions equal to each other, we'll force the equation to tell us how many hours worked would make the two amounts of money the same:

$$4.5h = 4h + 10$$

Let's solve it! First, we subtract 4h from both sides. Remember, when adding/subtracting *like terms*, we can just add/subtract their coefficients! So $4.5h - 4h = 0.5h$.

$$4.5h = 4h + 10$$

$$\rightarrow 4.5h \mathbf{- 4h} = 4h \mathbf{- 4h} + 10$$

$$\rightarrow 0.5h = 10$$

At this point, you could multiply both sides by 10, to get rid of the decimal, and then divide both sides by 5, OR, you might notice that 0.5 = $\frac{1}{2}$, and know that if you multiply both sides by 2, it will disappear: 2(0.5) = 1! Either way, you'll get the same answer...

→ $0.5h = 10$

→ $\mathbf{2}(0.5h) = \mathbf{2}(10)$

→ $\underline{h = 20}$

Okay, this says if you work for 20 hours, then their offers will be the same. Let's check that! If you work for your mom for 20 hours, then you'd get this much money: 4(20) + 10 = 80 + 10 = $90. If you work for your dad for 20 hours, you'd get this much money: (4.5)(20) = (4.5)(10)(2) = (45)(2) = $90. Yep! They're the same!

So for part b, we get $h = 20$.

Answer: **a. Mom's deal is better b. 20 hours**

4. Hunter is 3 years older than Duncan. Leslie is 4 years younger than Duncan. Together, their ages equal 41. How old is Leslie? How old is Duncan? How old is Hunter?

Alright, we see 3 unknowns, the ages of Hunter, Duncan, and Leslie. So let's call these *h*, *d*, and *l*. What information do we have? First, that Hunter is three years older than Duncan, so that means h is 3 more than *d*:

$h = 3 + d$

Also, we're told that Leslie is 4 years younger than Duncan, so *l* is 4 less than *d*. Again, we can translate this directly:

$l = d - 4$

Finally, we know that when all the ages are added together, the sum is 41:

$h + d + l = 41$

Okay... there are 3 equations and 3 variables. Notice that in our first two equations, we have h written in terms of *d*, and also l written in terms of *d*.

So, in the third equation, $h + d + l = 41$, we can use variable substitution pretty easily: Wherever we see *h*, we can substitute in "$3 + d$" and where we see *l*, we can substitute in "$d - 4$":

$$h + d + l = 41$$

becomes

$$(3 + d) + d + (d - 4) = 41$$

See how we substituted them in, using information we got from the first two equations? And now we can solve for d!

$$(3 + d) + d + (d - 4) = 41$$

Dropping the parentheses, we can add the 3 *d*'s together:

$$\rightarrow 3 + 3d - 4 = 41$$

Rewrite the subtraction as "adding a negative" if it helps:

$$\rightarrow 3 + 3d + (-4) = 41$$

Combine the constants on the right side:

$$\rightarrow 3d - 1 = 41$$

$$\rightarrow 3d = 42$$

$$\rightarrow \frac{3d}{\mathbf{3}} = \frac{42}{\mathbf{3}}$$

$$\rightarrow \underline{d = 14}$$

So, Duncan is 14 years old. Does this answer make sense? Well, if Duncan is 14, then Hunter (who is 3 years older) must be 17, and Leslie (who is 4 years younger than Duncan) would be 10. Add their ages: 14 + 17 + 10 = 41. Yep! We got the right answer! The problem asked for all their ages, so:

Answer: **Leslie is 10, Duncan is 14, and Hunter is 17.**